(No Model.)

T. A. EDISON.

SYSTEM OF ELECTRIC LIGHTING.

No. 438,301. Patented Oct. 14, 1890.

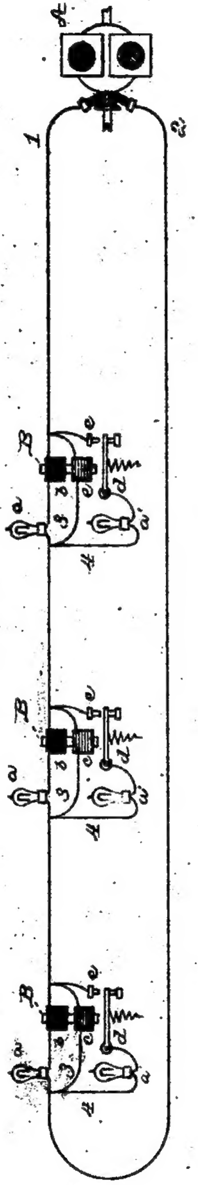

Fig 1.

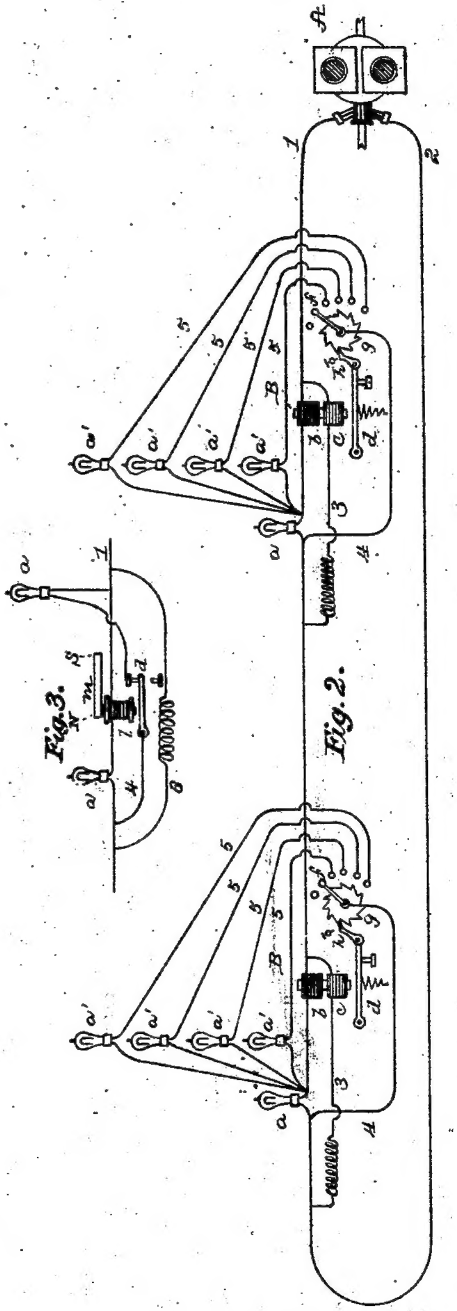

Fig. 3.

Fig. 2.

ATTEST:

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By Rich'd N. Dyer,

Att'y.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

SYSTEM OF ELECTRIC LIGHTING.

SPECIFICATION forming part of Letters Patent No. 438,301, dated October 14, 1890.

Application filed June 29, 1883. Serial No. 99,654. (No model.)

To all whom it may concern:

Be it known that I, Thomas A. Edison, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Systems of Electric Lighting, (Case No. 578,) of which the following is a specification.

The object of this invention is to provide a simple and efficient cut-out for electric lamps, which I prefer to employ with lamps of the incandescent variety, so that when a lamp-carbon breaks or when from any reason current ceases to pass through the lamp it will be cut out of circuit and circuit closed around it to an auxiliary lamp placed in a shunt, which cut-out mechanism shall be so arranged as to act with unusual promptness and to prevent spark, the circuit never being broken. I accomplish this by employing, preferably, a differential electro-magnet in connection with each lamp or group of lamps which it may be desirable to cut out of circuit at any time. Such differential magnet is so arranged that when current through the lamp or group thereof ceases its balance will be destroyed, and this will operate circuit-controlling apparatus which will close a shunt around the lamp, including an auxiliary lamp. I prefer to employ an electro-magnet having two differentially-wound sets of coils. The low-resistance coils of this magnet are in the main line, while its fine-wire or high-resistance coils are in a shunt around the lamp. A second shunt around the lamp includes the pivoted spring-retracted armature of the differential magnet, which armature is provided with contacts for making and breaking the shunt in which it is placed. The differential magnet is so wound and its armature so adjusted that when the lamp is burning the two sets of coils will balance each other, and said armature will be held away from the magnet by a spring; but should the lamp break and current cease to pass through it and through the low-resistance coils in the main line the magnetic balance will be destroyed and the armature will be attracted and close the circuit around the lamp. When the lamp is replaced, current will pass through the low-resistance coils, and the balance will be restored and the armature will be retracted by its spring and break the shunt. The shunt controlled by the armature-lever may be divided into any desired number of branches, each including an incandescing lamp. These divisions are closed and broken by an arm included in the main portion of the shunt and carried by a ratchet-wheel revolved by a pawl carried by the armature-lever. When the first lamp breaks, the armature is attracted and its pawl moves the ratchet-wheel and contact-arm, closing the first division of the shunt; and if the lamps in this division break, circuit is closed through the next one, and so on, the lamps being successively thrown into circuit as the preceding ones are destroyed.

While I prefer to employ the differential electro-magnetic device described, it is evident that a single electro-magnet placed in a shunt around the lamp may be used to control the second shunt. When the lamp-circuit is broken, current passes through this magnet, which attracts the armature-lever and closes the shunt. Another differential arrangement, however, may be used, consisting of a low-resistance magnet-coil in the main line and a permanent magnet acting oppositely upon the armature and maintaining a magnetic balance when current is passing through the coil, but overcoming said coil when the main circuit is broken.

The invention is illustrated in the annexed drawings, in which—

Figure 1 is a diagram of the form in which only one auxiliary shunt around the lamp is used; Fig. 2, a diagram showing the arrangement for throwing lamps successively into circuit, and Fig. 3 an illustration of the differential device employing a permanent magnet.

Referring to Figs. 1 and 2, A represents a dynamo-electric machine or other generator for supplying current to the incandescing electric lamps a a, arranged in series in the main conductors 1 2.

B B are magnet-cores, each wound with coarse wire or low-resistance coils b, included in the main circuit, and fine wire or high-resistance coils c, included in the shunt-circuit 3 around the lamp. The two sets of coils are wound to oppose each other, forming a differential magnet. Another shunt-circuit 4 is also formed around the lamp, containing an auxiliary lamp a' and including the pivoted armature d and contact-point e.

When a lamp a is destroyed or the current is in any way prevented from passing through such lamp, the balance of the magnetic attraction upon the armature-lever d is destroyed and said lever is attracted, as previously explained, and closes the shunt-circuit 4 through the lamp a'.

In the arrangement shown in Fig. 2 the armature-lever d is not included in the shunt-circuit 4; but such circuit runs to the arm f, which is carried by the ratchet-wheel g, and said circuit is divided into a number of branches 5 5, each of which branches includes a lamp a'. Such branches all return to the main line at a point beyond the lamp a. The armature-lever d carries a pawl h, which, when the armature is attracted by the differential magnet, engages with the ratchet-wheel g and throws the contact-arm f from one branch 5 to another. Thus, if current ceases in the lamp a, the armature is attracted, the ratchet-wheel turned, and the contact-arm thrown to the branch 5, including the first lamp a', and should this lamp be destroyed the next is likewise thrown into circuit, and so on.

In the arrangement illustrated in Fig. 3, instead of a core with opposite windings, I use an electro-magnet l of low resistance in the main line and an opposing permanent magnet m, both acting upon the armature-lever d. The shunt 4 is here shown as closed, the magnetic balance having been destroyed by the breaking of the lamp a. A high-resistance shunt 6 is formed around the lamp and cut-out mechanism, so that the circuit is never broken. It will be seen that by these devices the circuit is never broken, as in each arrangement a constantly-closed circuit is provided in connection with the lamp and cut-out mechanism, and consequently no spark occurs; also, the differential magnet, with coils in the main line, acts with greater quickness than those cut-outs in which a single magnet in the main line allows an armature to drop and close a shunt.

As above stated, a magnet c in shunt 3 might be used alone to control the shunt 4; but the differential arrangement is preferred.

It is to be understood that all patentable features of invention described or shown but not claimed herein are reserved for protection in other patents and have been or will be embodied in other applications for patents.

What I claim is—

1. The combination, with an electric lamp, of cut-out mechanism actuated by cessations of current, one or more shunts around said lamp controlled by said cut-out mechanism each including a similar lamp, and a constantly-closed circuit around said lamp, substantially as set forth.

2. The combination, with an electric lamp, of a single cut-out device actuated by cessations of current, two or more shunts around said lamp controlled by said cut-out device, each shunt containing another lamp, and a constantly-closed shunt around all the lamps, substantially as set forth.

3. The combination, with an electric lamp, of two or more shunts around said lamp, each including another lamp, a single cut-out device actuated by cessations of current in one lamp to close circuit successively to the succeeding lamps, and a constantly-closed shunt all around the lamps, substantially as set forth.

4. The combination, with an electric lamp, of electro-magnetic cut-out apparatus operated by cessations of current, two or more shunts around said lamp, each including another lamp, a pawl and ratchet-wheel actuated by said cut-out mechanism, and a circuit-controlling arm carried by said ratchet-wheel for successively closing said two or more shunts, substantially as set forth.

5. The combination of an electric lamp, a differential magnet having coils in the lamp-circuit, circuit-controlling mechanism operated by variations in the magnetic balance of said magnet, and one or more shunts around said lamp, all controlled by said mechanism and each including a similar lamp.

This specification signed and witnessed this 25th day of June, 1883.

THOS. A. EDISON.

Witnesses:

H. W. SEELY,

,301

Correction in Letters Patent No. 438,301.

It is hereby certified that in Letters Patent No. 438,301, granted October 14, 1890, upon the application of Thomas A. Edison, of Menlo Park, New Jersey, for an improvement in "System of Electric Lighting," an error appears in the printed specification requiring correction, as follows: In line 78, page 2, the words "all around" should read *around all;* and that the Letters Patent should be read with this correction therein to make it conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 25th day of November, A. D. 1890.

[SEAL.]

CYRUS BUSSEY,
Assistant Secretary of the Interior.

Countersigned:
C. E. MITCHELL,
Commissioner of Patents.